MYXOMATOSIS IN RABBITS

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Rome, Italy

The first indications that the myxoma virus could cause widespread disease among rabbits were recorded in Uruguay in 1898, following which widespread mortality from the infection was reported in Argentina, Brazil and Southern California. Evidence was produced in 1942 that the infection may be present in a mild form without symptoms or lesions of generalization and with little or no mortality, in wild rabbits in Brazil.

The causal agent of myxomatosis is a filterable virus which bears some relationship to the fibroma virus described by Shope. It is highly probable that the Shope virus is an attenuated or modified form of the myxoma virus and because of this likelihood, the Shope virus is used as a vaccine in protecting rabbits against myxomatosis.

Myxomatosis affects mostly rabbits, including Belgian hares and Flemish giants. The cotton tail and jack rabbits of the U.S.A. are resistant as are human beings and all other animal species. The disease has been recorded on rare occasions as affecting the hare in France and the United Kingdom.

As was to be expected, with the information available on the rapid spread of myxomatosis among rabbits and the high mortality among infected animals, attention was directed towards using the virus for reducing or even eradicating rabbits from areas or countries where they were considered to be a pest.

Early experiments were largely unsuccessful because it was not realized that mere contact between infected and healthy animals was not the most important method of spread of the infective agent. It became evident that actual wounding of the skin by any agent contaminated with, or carrying, the virus is the surest way of infecting

a rabbit. Biting insects, therefore, are probably the most important agents in the spread of myxomatosis. The species of the insect will determine the range of spread : thus, if rabbits are exposed to fleas only, spread will usually be limited to rabbit colonies without outbreaks occurring at any great distance from the infected colony. On the other hand, where environmental and climatic conditions are suitable for mosquitoes which feed largely on rabbits, wide distribution of the disease is to be expected. It can also be seen that, when both fleas and mosquitoes are involved, the season of the year will have an important bearing on the rate and extent of spread.

The infective agent does not seem to undergo any change in the vectors, which act as carriers only. It appears also from experimental evidence that infection is not usually transmitted by mouth.

It has been shown that, in addition to fleas and mosquitoes, certain species of flies, lice and mites may also act as vectors.

In rabbits in a highly susceptible state the first characteristic symptoms following infection occur in 5 to 7 days when there appears a conjunctivitis with a watery discharge which later becomes purulent one or two days later. There is high fever, the infected animal becomes listless and does not feed. Some rabbits exposed to highly virulent forms of the virus die in about two days after the symptoms appear. More commonly, however, the disease progresses, the animals becoming more and more depressed. Swellings appear at the base of the ears, around the eyes, nose and chin and in the vicinity of the anus. In the male the serotum becomes involved and in both sexes there may be swellings on the legs and on different parts of the body. The swellings are oedematous in character and cause a drooping of the ears. A nasal discharge is common. Coma and death often occur within one to two weeks of the first appearance of symptoms. Occasionally, however, the affected animal may survive for several weeks when hard, filutoric nodules appear on the nose, ears and forefeet.

Except for the occurrence of the swellings and the hard nodules described above, there are no specific or characteristic lesions associated with myxomatosis. The disease is diagnosed by the clinical symptoms, the usual high mortality and, if doubt exists, the transmission of the infecting virus to susceptible rabbits, i.e. the setting up of the typical disease by the injection of material from the lesions. Such material sets up the disease only in susceptible rabbits and in no other animals.

When the myxoma virus is first introduced into colonies of susceptible rabbits and spreads throughout an area, the mortality approaches 100 per cent. In time, however, rabbits which have apparently recovered from myxomatosis are found in such areas : they show flat scars on parts of the body, corresponding to those where the oedematous swellings are normally found in infected animals. Moreover, it has been shown in south-east Australia that many of the survivors of a virulent outbreak of myxomatosis possess protective antibodies; in other words, they have developed an immunity to the infecting virus. This is to be expected for in all epizootics or epidemics, caused by highly virulent infectious agents, a time and state are reached when resistance in the form of immunity develops at least to some degree.

In some parts of the world where it is desired to protect rabbits against the myxoma virus, inoculation with the Shope fibroma virus is carried out. It is not claimed that this fibroma virus will set up a true immunity but, by interference, induces a serviceable resistance in nearly 90 per cent of treated animals. The resistance usually lasts for some six months but may be overcome at any time by exposure to a high degree of infection.

In studying the epizootology of myxomatosis, the factors concerned in the spread of the virus have to be taken into account. It was not until the vectors were indentified that explanations were forthcoming on the different rate of spread and the successes and failures to produce widespread infection in an area or country. There may still be some difficulty in appreciating how the infection may appear in widely-separated parts of a country.

Myxomatosis was purposely introduced into parts of Australia with a view to reducing or ultimately eradicating the rabbit population. In Europe, the disease, purposely introduced into France for a specific and very limited purpose, spread rapidly to most of the Western European countries, including Great Britain. Although there is little doubt that much of the infection entered the countries through infected rabbits crossing over frontiers, intentional introduction has also to be considered. The spread in Europe has been most rapid in the most densely populated rabbit areas and has occurred mostly during summer. In Great Britain, the first outbreak of myxomatosis was confirmed in Kent in October 1953; within four days another outbreak was reported in East Sussex and, in spite of the application of early

control measures and the slow spread of the infection at the beginning of the occurrence, myxomatosis has now been recorded in most counties with the result that the over-all rabbit population has been reduced to its lowest level for over a century.

The immediate effects of the introduction of myxomatosis into a country, with the consequent rapid reduction in the rabbit population, are seen in increased agricultural yields. It has only been since the rabbit population has been markedly reduced in an area that the losses caused by rabbits have been appreciated. It has been estimated that the annual loss to agriculture from damage done by rabbits in Great Britain was some fifty million pounds and that in counties now practically free from rabbits there is an increase of about 25 per cent in crop yield. In England and Wales, an increase in cereals of two hundredweights per acre is attributed to the clearing of rabbits from the more densely populated areas and it is believed that greater yields may be expected. With the lowered consumption of pastures in areas from which the rabbits have been cleared, more becomes available for livestock so that there is a greater livestock-carrying capacity. It is stated that near woods and former scrub land it has amounted to some 50 per cent. Crops such as brassicas, carrots and other market garden products, for the preservation of which rabbit-proof fencing was required are now being produced at lower cost where protection against rabbit invasion is no longer necessary. The very valuable early pasture in the spring, considered important in the life of livestock is available two to three weeks earlier : there is therefore a saving of expense in feeding concentrates during this critical period. Bankings and drainage ditches require less attention where there are no rabbits to undermine them and fill them in with their burrowings. It would appear, therefore, from such evidence, that agriculture in general is benefitting from the introduction of myxomatosis.

The effects of the disease on silviculture will take longer to estimate due to the long period required for the maturing of timber. Even here, however, it has been noted that regeneration has been improved where rabbits no longer are present to eat the seedlings and shoots in spite of recent poor weather conditions. In silviculture, savings are also being made for, with the disappearance of rabbits, rabbit-proof fences are no longer required and so encouragement is given to plant more trees. The real effect of myxomatosis will be felt some years hence.

On uncultivated land the decrease in the rabbit population has allowed for better coverage by herbage and opportunities for natural selection to produce better types of plants. This is important for its effect on soil erosion.

Up to the present, the decrease in the rabbit population does not seem to have had much effect on the numbers of the different wild fauna.

It is difficult at this stage to form accurate estimates of the future effects of myxomatosis in a country. Because of the immediate results, as shown by increased agricultural yields, the tendency is to allow the disease to spread and to take measure to exterminate the rabbits in an area which, for any reason, fail to develop the disease or which recover from infection.

Time will show whether it is possible entirely to rid a country of its rabbit population. It is safe to predict that myxomatosis alone will not exterminate rabbits from a country for natural resistance will be found in some and immune strains are sure to develop. As with all disease due to a virulent infective agent, there is a rapid spread among the susceptible animal population : this will be slowed down as immunity is set up and as less virulent strains of the virus appear. There will thus be established a balance between the virulence of the virus and the resistance of the rabbit.

There remains to be seen in how far the rapid immediate reduction of the rabbit population will have repercussions on other animal life. No doubt, balances will be struck.